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REFERENCES CITED

- Beck, B.F., and Sayed, Sayed, 1991, The sinkhole hazard in Pinellas County—A geologic summary for planning purposes: Orlando, Florida Sinkhole Research Institute Report 90-91-1, 58 p.
- Beck, B.F., and Sinclair, W.C., 1986 Sinkholes in Florida—An introduction: Orlando, Florida Sinkhole Research Institute Report 85-86-4, 18 p.
- Bell, J.W., Price, J.G., and Mifflin, M.D., 1992, Subsidence-induced fissuring along preexisting faults in Las Vegas Valley, Nevada, *in* Stout, M.L., ed., Proceedings of 35th Annual Meeting of the Association of Engineering Geologists, October 2–9, 1992, Long Beach, California, p. 66–75.
- Bjerrum, L., 1969, Soil with water—transient flow, *in* Lambe, T.W., and Whitman, R.V., eds., Soil Mechanics: New York, John Wiley and Sons, p. 388–522.
- Blodgett, J.C., and Williams, J.S., 1992, Land subsidence and problems affecting land use at Edwards Air Force Base, California, 1990: U.S. Geological Survey Water-Resources Investigations Report 92-4035, 25 p.
- Bredehoeft, J.D., 1967, Response of well-aquifer systems to earth tides: Journal of Geophysical Research, v. 72, p. 3075-3087.
- California State Water Resources Control Board, 1974, Water quality control plan report, South Lahontan basin: California State Water Resources Control Board, 300 p.
- Carpenter, M.C., 1993, Earth-fissure movements associated with fluctuations in ground-water levels near the Picacho Mountains, south-central Arizona, 1980–84: U.S. Geological Survey Professional Paper 497-H, 116 p.
- Collins, James, 1989, Fundamentals of GPS baseline and height determinations: American Society of Civil Engineers, Journal of Surveying Engineering, v. 115, no. 2, p. 223–235.
- Contaldo, G.J., and Mueller, J.E., 1991, Earth fissures of the Mimbres Basin, southwestern New Mexico: New Mexico Geology, v. 13, p. 69–74.
- Dibblee, T. W., Jr., 1967, Areal geology of the western Mojave Desert, California: U.S. Geological Survey Professional Paper 522, 153 p.
- Dixon, G.L., and Ward, A.W., 1994a, Preliminary geologic map of the Edwards Quadrangle, Kern County, California: U.S. Geological Survey open-file map, map scale 1:24,000.
- Dixon, G.L., and Ward, A.W., 1994b, Preliminary geologic map of the Rogers Lake South Quadrangle, Los Angeles and Kern Counties, California: U.S. Geological Survey open-file map, map scale 1:24,000.
- Dixon, T.H., 1991, An introduction to the Global Positioning System and some geological applications: Reviews of Geophysics, v. 29, no. 2, p. 249–276.
- Durbin, T.J., 1978, Calibration of a mathematical model of the Antelope Valley ground-water basin, California: U.S. Geological Survey Water-Supply Paper 2046, 51 p.
- Epstein, V.J., 1987, Hydrologic and geologic factors affecting land subsidence near Eloy, Arizona: U.S. Geological Survey Water-Resources Investigations Report 87-4143, 28 p.
- Federal Geodetic Control Committee, 1989, Geometric geodetic accuracy standards and specifications for using GPS relative positioning techniques, Version 5.0 with corrections: National Geodetic Survey, National Oceanic and Atmospheric Administration, 48 p.
- Fernandez, Gabriel, 1991, Report of brine field subsidence, Appendix B, *in* Haley and Aldrich of New York. A projection of future geologic conditions in the Tully Valley, Onondaga County, New York: Rochester, New York, v. 2, appendices, 17 p.

- Fett, J.D., 1968, Geophysical investigation of the San Jacinto Valley, Riverside County, California: Riverside, California, University of California, M.A. thesis, 87 p.
- Fett, J.D., Hamilton, D.H., and Fleming, F.A., 1967, Continuing surface displacement along the Casa Loma and San Jacinto faults in San Jacinto Valley, Riverside County, California: Engineering Geology, v. 4, p. 22–32.
- Friesen, R.L., 1992, Cyclic flexure of surficial strata near an earth fissure in the Mimbres Basin, southern New Mexico: Socorro, New Mexico Institute of Mining and Technology, M.S. thesis, 86 p.
- Getchell, F. A., 1982, Subsidence in the Tully Valley, New York: Syracuse University, unpublished master of science thesis, 144 p.
- Haneberg, W.C., 1992, Drape folding of compressible elastic layers, I. Analytical solutions for vertical uplift: Journal of Structural Geology, v. 14, no. 6, p. 713-721.
- Haneberg, W.C., 1993, Drape folding of compressible elastic layers, II. Matrix solution for two-layer folds: Journal of Structural Geology, v. 15, in press.
- Haneberg, W.C., and Friesen, R.L., 1993, Tilting of surficial strata and groundwater level fluctuations in the subsiding Mimbres Basin, New Mexico: Las Cruces, New Mexico Water Resources Research Institute Report 274, 85 p.
- Haneberg, W.C., Reynolds, C.B., and Reynolds, I.B., 1991, Geophysical characterization of soil deformation associated with earth fissures near San Marcial and Deming, New Mexico, *in* Johnson, A.I., ed., Land Subsidence—Proceedings of Fourth International Symposium on Land Subsidence, Houston, Texas, May 12–18, 1991: International Association of Hydrological Sciences Publication no. 200, p. 271–280.
- Hanson, R.T., 1989, Aquifer system compaction, Tucson Basin and Avra Valley, Arizona, U.S. Geological Survey Water-Resources Investigations Report 88-4172, 69 p.
- Helm, D.C., 1974, Evaluation of stress-dependent aquitard parameters by simulating observed compaction from known stress history: Berkeley, University of California, Ph.D. dissertation, 175 p.
- Helm, D.C., 1987, Three-dimensional consolidation theory in terms of the velocity of solids: Geotechnique, v. 37, no. 3, p. 369–392.
- Helm, D.C., 1992, Forces that play a role in generating fissures at depth, *in* Stout, M.L., ed., Proceedings of 35th Annual Meeting of the Association of Engineering Geologists, October 2–9, 1992: Long Beach, California, p 7-16.
- Helm, D.C., 1994, Horizontal aquifer movement of a Theis-Thiem confined system: Water Resources Research, v. 30, no. 4, p. 953–964.
- Holzer, T.L., 1981, Preconsolidation stress of aquifer systems in areas of induced land-subsidence: Water Resources Research, v. 1, no. 3, p. 693–704.
- Holzer, T.L., ed., 1984, Man-induced land subsidence: Reviews in Engineering Geology, v. 6, 221 p.
- Holzer, T.L., Davis, S.N., and Lofgren, B.E., 1979, Faulting caused by groundwater extraction in south-central Arizona: Journal of Geophysical Research, v. 84, no. B2, p. 603–612.
- Ikehara, M.E., and Phillips, S.P., 1994, Determination of land subsidence related to ground-water-level declines using global positioning system and leveling surveys in Antelope Valley, Los Angeles and Kern Counties, California, 1992, U.S. Geological Survey Water-Resources Investigations Report 94-4184, 101 p.
- Ireland, R.L., Poland, J.F., and Riley, F.S., 1984, Land subsidence in the San Joaquin Valley, California, as of 1980: U.S. Geological Survey Professional Paper 437-I, 93 p.
- Jachens, R.C. and Holzer, T.L., 1979, Geophysical investigations of ground failure related to ground-water withdrawal—Picacho Basin, Arizona: Ground Water, v. 17, p. 574–585.
- Jacob, C.E., 1940, The flow of water in an elastic artesian aquifer: EOS, American Geophysical Union Transactions, v. 21, p. 574–586.
- Land, L.F., and Armstrong, C.A., 1985, A preliminary assessment of land-surface subsidence in the El Paso area, Texas: U.S. Geological Survey Water- Resources Investigations Report 85-4155, 96 p.
- Langbein, J., Hill, D.P., Parker, T.N., and Wilkinson, S.K., 1993, An episode of reinflation of the Long Valley caldera, eastern California, 1989–1991: Journal of Geophysical Research, v. 98, p. 851–870.
- Langbein, J.O., Hill, D.P., Parker, T.N., Wilkinson, S.K., and Pitt, A.M., 1990, Renewed inflation of the resurgent dome in Long Valley caldera, California, from mid-1989 to mid-1990 (abstract): EOS, American Geophysical Union Transactions, v. 71, no. 43, p. 1466.
- Larsen, M.K., and Péwé, T.L., 1986, Origin of land subsidence and earth fissuring, northeast Phoenix, Arizona: Bulletin of the Association of Engineering Geologists, v. 23, p. 139–161.
- Leake, S.A., 1990, Interbed storage changes and compaction in models of regional ground-water flow: Water Resources Research, v. 26, no. 9, p. 1939–1950.

- Leake, S.A., 1991, Simulation of vertical compaction in models of regional ground-water flow, in Johnson, A.I., ed., Land subsidence—Proceedings of Fourth International Symposium on Land Subsidence, Houston, Texas, May 12–18, 1991: International Association of Hydrological Sciences Publication no. 200, p. 565–574.
- Leake, S.A., 1992, Computer simulation of land subsidence from groundwater withdrawal in unconfined aquifers: Seismological Press, Proceedings of International Workshop on Groundwater and Environment, Beijing, China, August 16–18, 1992, p. 286–292.
- Leake, S.A., and Prudic, D.E., 1991, Documentation of a computer program to simulate aquifer-system compaction using the modular finite-difference ground-water flow model: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 6, Chapter A2, 68 p.
- Lee, K.L., and Shen, C.K., 1969, Horizontal movements related to subsidence: Journal of the Soil Mechanics and Foundation Division, American Society of Civil Engineers, v. 95, no. SM1, p. 139-166.
- Lewis, R.E., and Miller, R.E., 1968, Geologic and hydrologic maps of the southern part of Antelope Valley, California, supplement to U.S. Soil Conservation Service Report on the cooperative soil survey of Antelope Valley area, California: U.S. Department of Agriculture Report, 13 p.
- Lofgren, B.E., 1976, Land subsidence and aquifer-system compaction in the San Jacinto Valley, California: Journal of Research of the U.S. Geological Survey, v. 4, no. 1, p. 9–18.
- Lofgren, B.E., 1978, Hydraulic stresses cause ground movement and fissures, Picacho, Arizona?: Geological Society of America Abstract with Programs, v. 10, no. 3, p. 271.
- Lofgren, B.E., and Rubin, Meyer, 1975, Radiocarbon dates indicate rates of graben downfaulting, San Jacinto Valley, California: Journal of Research of the U.S. Geological Survey, v. 3, no. 1, p. 45–46.
- Londquist, C.J., Rewis, D.L., Galloway, D.L., and McCaffrey, W.J., 1993, Hydrogeology and land subsidence, Edwards Air Force Base, Antelope Valley, California: U.S. Geological Survey Water-Resources Investigations Report 93-4114, 74 p.
- Mabey, D. R., 1960, Gravity survey of the western Mojave Desert, California: U.S. Geological Survey Professional Paper 316-D, p. 51–73.
- McDonald, M.G., and Harbaugh, A.W., 1988, A modular three-dimensional finite-difference ground-water flow model: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 6, Chapter A1, 548 p.
- Milbert, D.G., 1991a, Computing GPS-derived orthometric heights with the GEOID90 geoid height model: ACSM-ASPRS Fall Convention, Atlanta, Georgia, October 28–November 1, 1991, p. A46–55.
- Milbert, D.G., 1991b, GEOID90—A high-resolution geoid for the United States: EOS, v. 72, no. 49, p. 545.
- Morin, R.L., Mariano, John, and Jachens, R.C., 1990, Isostatic residual gravity map of Edwards Air Force Base and vicinity, Kern, Los Angeles, and San Bernardino Counties, California, U.S. Geological Survey Open-File Report 90-664, scale 1:62,500.
- Morton, D.M., 1972, Geology of the Lakeview and Perris (7.5') quadrangles, Riverside County, California: California Division of Mines and Geology Map Sheet 19.
- Morton, D.M., 1977, Surface deformation in part of the San Jacinto Valley, southern California: Journal of Research of the U.S. Geological Survey, v. 5, no. 1, p. 117–124.
- Morton, D.M., and Sadler, P.S., 1989, Landslides flanking the northeastern Peninsular Ranges and in the San Gorgonio Pass area of southern California, *in* Sadler, P.M., and Morton, D.M., eds., Landslides in a semi-arid environment: Inland Geological Society Publication, v. 2, p. 183–197.
- National Oceanic and Atmospheric Administration, Federal Geodetic Control Committee, 1980, Classification, standards of accuracy, and general specifications of geodetic control surveys: U.S. Department of Commerce, 12 p.
- National Research Council, 1991, Mitigating losses from land subsidence in the United States: Report of the Committee on Ground Failure Hazards and Mitigation Research, Division of Natural Hazard Mitigation, Commission on Engineering and Technical Systems, National Academy Press, Washington, D.C., 58 p.
- Neal, J.T., 1965, Geology, mineralogy, and hydrology of U.S. playas: Air Force Cambridge Research Laboratories, 176 p.
- Okada, Y., 1985, Surface deformation due to shear and tensile faults in a half-space: Bulletin of the Seismological Society of America, v. 75, no. 4, p. 1135-1154.
- Poland, J.F., editor, 1984, Guidebook to studies of land subsidence due to ground-water withdrawal: United Nations Educational, Scientific, and Cultural Organization, no. 40 of UNESCO Studies and Reports in Hydrology, Paris, France, 305 p.

- Poland, J.F., Lofgren, B.E., Ireland, R.L., and Pugh, R.G., 1975, Land subsidence in the San Joaquin Valley as of 1972: U.S. Geological Survey Professional Paper 437-H, 78 p.
- Proctor, R.J., 1962, Geologic features of a section across the Casa Loma fault, exposed in an aqueduct trench near San Jacinto, California: Geological Society of America Bulletin, v. 73, p. 1293–1296.
- Quilty, E.G., and Roeloffs, E.A., 1991, Removal of barometric pressure response from water-level data, Journal of Geophysical Research, v. 96, no. B6, p. 10209–10218.
- Riley, F.S., 1969, Analysis of borehole extensometer data from central California, in Tison, L.J., ed., Land Subsidence: Tokyo, International Association of Scientific Hydrology Publication 89, v. 2, p. 423–431.
- Rojstaczer, S.A., 1988, Determination of fluid flow properties from the response of water wells to atmospheric loading: Water Resources Research, v. 24, p. 1927–1938.
- Rojstaczer, S.A., and Agnew, D.C., 1989, The influence of formation material properties on the response of water levels in wells to earth tides and atmospheric loading: Journal of Geophysical Research, v. 94, no. B6, p. 12403–12411.
- Savage, J.C., 1988, Principal component analysis of geodetically measured deformation in Long Valley caldera, eastern California: Journal of Geophysical Research, v. 93, no. B11, p. 13297–13305.
- Sinclair, W.C., 1982, Sinkhole development resulting from ground-water withdrawal in the Tampa area, Florida: U.S. Geological Survey Water-Resources Investigations Report 81-50, 19 p.
- Snyder, J.H., 1955, Ground water in California—The experience of Antelope Valley: Berkeley, University of California, Division of Agriculture Science, Giannini Foundation Ground-Water Studies No. 2, 171 p.
- Templin, W.E., Phillips, S.P., Cherry, D.E., DeBortoli, M.L., and others, 1994, Land use and water use in the Antelope Valley, California, U.S. Geological Survey Water-Resources Investigations Report 94-4208, 97 p.
- Terzaghi, Karl, 1925, Erdbaumechanik auf Bodenphysikalischer Grundlage: Wein Leipzig, Deuticke, 399 p.
- Ventura County Board of Supervisors, 1988, Ventura County general plan, goals, policies, and programs—hazards appendix: Ventura County Board of Supervisors document No. 1D297-1.90 and No. I198, adopted May 24, 1988, 146 p.
- Ward, A.W., and Dixon, G.L., 1994a, Preliminary geologic map of the Redman Quadrangle, Los Angeles and Kern Counties, California, U.S. Geological Survey open-file map; map scale 1:24,000.
- Ward, A.W., and Dixon, G.L., 1994b, Preliminary geologic map of the Rogers Lake North Quadrangle, Kern County, California, U.S. Geological Survey open-file map; map scale 1:24,000.
- Waring, G.A., 1919, Ground water in the San Jacinto and Temecula basins, California: U.S. Geological Survey Water-Supply Paper 429, 113 p.
- White, D.E., 1983, Summary of hydrologic information in the El Paso, Texas, area, with emphasis on ground-water studies, 1903–1980: U. S. Geological Survey Open File Report 83-775, 77 p.
- Wright, R.V., 1924, Report on agriculture, economic, and ground-water situation, Antelope Valley, California: Federal Land Bank of Berkeley, November 6, 1924, 115 p.
- Yeats, R.S., 1983, Large-scale Quaternary detachments in the Ventura basin, southern California: Journal of Geophysical Research, v. 88, p. 569–583.
- Zettlemoyer, B., 1990, 1988 annual water use-water supply balances: California Department of Water Resources Memorandum Report, 59 p.
- Zohdy, A.A.R, and Bisdorf, R.J., 1990, Ground-water exploration using deep Schlumberger soundings at Edwards Air Force Base, California, Part I—Graham Ranch and Rogers Lake: U.S. Geological Survey Open-File Report 90-536, 95 p.
- Zohdy, A.A.R., and Bisdorf, R.J., 1991, Ground-water exploration using deep Schlumberger soundings at Edwards Air Force Base, California, Part II—Rogers Lake and North of Edwards Air Force Base: U.S. Geological Survey Open-File Report 91-446, 109 p.